

WHAT IS CLAIMED IS:

1. A method for randomly phase modulating a radar altimeter, said method comprising:

a) momentarily applying a signal from a random noise source to an input of an amplifier;

5 b) applying an output of the amplifier, the output based on the random noise input, to a voltage controlled oscillator;

10 c) applying an output of the voltage controlled oscillator to a transmitter and mixer of the radar altimeter to modulate transmissions of the radar altimeter and to demodulate reflected radar transmissions received by the radar altimeter;

d) holding the output of the amplifier constant from before a radar altimeter transmission until after reception of the reflected radar signals from that transmission by the radar altimeter; and

e) repeating steps a), b), and d).

15 2. A method according to Claim 1 wherein momentarily applying a signal from a random noise source comprises closing, then opening a switch located between the random noise source and the amplifier.

20 3. A method according to Claim 2 wherein holding the output of the amplifier constant comprises keeping the switch open from the beginning of the radar altimeter transmission until the reflected radar signals from that transmission are received by the radar altimeter.

4. A method according to Claim 1 further comprising filtering the signal from the random noise source to control a frequency spectrum of the random noise.

5. A method according to Claim 1 further comprising filtering the output of the amplifier.

6. A method according to Claim 1 wherein holding the output of the amplifier constant comprises utilizing a capacitor between an input of the amplifier and a ground of the radar altimeter to hold the voltage substantially constant at the input of the amplifier.

7. A method according to Claim 1 wherein holding the output of the amplifier constant comprises adjusting a band-pass filter between the random noise source and the amplifier to provide a substantially constant phase during the time from a beginning of the radar altimeter transmission until the reflected radar signals from that transmission are received by the radar altimeter.

8. A method for randomly phase modulating a radar altimeter, the radar altimeter including a voltage controlled oscillator having an output which modulates transmissions of the radar altimeter and demodulates reflected radar transmissions received by the radar altimeter, said method comprising:

configuring the voltage controlled oscillator to provide a random phase modulation source; and

holding the phase of the modulation source substantially constant from a time when the radar altimeter transmits a radar signal until a time when a reflection of the transmitted radar signal is received by the radar altimeter.

9. A method according to Claim 8 wherein configuring the voltage controlled oscillator to provide a random phase modulation source comprises utilizing thermal noise within an amplifier of the voltage controlled oscillator to determine a phase of the modulation source.

10. A method according to Claim 9 wherein utilizing thermal noise within an amplifier of the voltage controlled oscillator to determine a phase of the modulation source comprises:

removing DC power from the voltage controlled oscillator for a time sufficient enough for an output signal of the voltage controlled oscillator to decay; and  
restoring DC power to the voltage controlled oscillator.

5 11. A method according to Claim 9 wherein utilizing thermal noise within an amplifier of the voltage controlled oscillator to determine a phase of the modulation source comprises biasing the amplifier within the voltage controlled oscillator to an OFF condition after receiving the reflection of the transmitted radar signal.

10 12. A method according to Claim 8 wherein configuring the voltage controlled oscillator to provide a random phase modulation source comprises applying an impulse voltage to one of an amplifier in the voltage controlled oscillator and a frequency determining circuit within the voltage controlled oscillator, the impulse voltage timing being random with respect to a phase of the modulation source.

15 13. A radar altimeter comprising:  
a voltage controlled oscillator for modulating transmissions of said radar altimeter and demodulating reflected radar transmissions received by said radar altimeter;

a random noise source;

20 a holding circuit configured to sample a voltage from said random noise source and hold the voltage constant at an input to said voltage controlled oscillator from the time a signal is transmitted by said radar altimeter until a reflected radar return signal is demodulated by said radar altimeter.

25 14. A radar altimeter according to Claim 13 wherein said random noise source comprises at least one of a noise diode connected to an input of an amplifier, and a resistor connected to an input of an amplifier, the amplifier having a gain in excess of 1000.

15. A radar altimeter according to Claim 13 further comprising a band pass filter connected between said random noise source and said holding circuit, said band pass filter controlling a frequency spectrum of the random noise from said random noise source.

5 16. A radar altimeter according to Claim 13 wherein said holding circuit comprises:

an amplifier comprising an input and an output, said output connected to an input of said voltage controlled oscillator; and

10 a switch connected between said input of said amplifier and said random noise source, said switch configured to be open from the time a signal is transmitted by said radar altimeter until a reflected radar return signal is demodulated by said radar altimeter.

15 17. A radar altimeter according to Claim 16 further comprising a capacitor connected from an input of said amplifier to a ground of said radar altimeter, said capacitor holding a voltage substantially constant at said input of said amplifier when said switch is open.

20 18. A radar altimeter comprising a voltage controlled oscillator for modulating transmissions of said radar altimeter and demodulating reflected radar transmissions received by said radar altimeter, said voltage controlled oscillator configured to randomly phase modulate the transmissions of said radar altimeter, said voltage controlled oscillator comprising an amplifier therein.

19. A radar altimeter according to Claim 18 wherein to randomly modulate the transmissions, said radar altimeter is configured to:

25 remove DC power from said voltage controlled oscillator after a reflected radar transmission is received by said radar altimeter;

allow sufficient time for an output signal from said voltage controlled oscillator to decay; and

reapply power to said voltage controlled oscillator in time to modulate the next radar transmission, the random phase of the modulation being determined by thermal noise generated in said amplifier of said voltage controlled oscillator.

5           20.     A radar altimeter according to Claim 18 wherein to randomly modulate the transmissions, said radar altimeter is configured to:

        bias said amplifier in said voltage controlled oscillator to an OFF condition after a reflected radar transmission is received by said radar altimeter;

        allow sufficient time for an output signal from said voltage controlled oscillator to decay; and

10                 bias said amplifier in said voltage controlled oscillator to an ON condition in time to modulate the next radar transmission, the random phase of the modulation being determined by thermal noise generated in said amplifier of said voltage controlled oscillator.

15           21.     A radar altimeter according to Claim 18 wherein said voltage controlled oscillator further comprises a frequency determining circuit, wherein to randomly modulate the transmissions, said radar altimeter is configured to apply an impulse voltage to one of said amplifier and said frequency determining circuit within said voltage controlled oscillator, the impulse voltage timing being random with respect to a phase of an output of said voltage controlled oscillator.

20           22.     A circuit for randomly phase modulating transmissions of a radar altimeter and demodulating reflected radar transmissions received by the radar altimeter, the radar altimeter including a voltage controlled oscillator, said circuit connected to an input of the voltage controlled oscillator, said circuit comprising:

        a random noise source;

25                 an amplifier comprising an input and further comprising an output connected to the voltage controlled oscillator; and

a switch, said switch between said random noise source and said input of said amplifier, said switch configured to be open from the time a signal is transmitted by the radar altimeter until a reflected radar return signal is demodulated by the radar altimeter.

5                   23.     A circuit according to Claim 22 further comprising a capacitor connected from an input of said amplifier to a ground of said radar altimeter, said capacitor holding a voltage substantially constant at said input of said amplifier when said switch is open.

10                   24.     A radar altimeter according to Claim 22 wherein said random noise source comprises at least one of a noise diode connected to an input of an amplifier, and a resistor connected to an input of an amplifier having a gain in excess of 1000.

15                   25.     A radar altimeter according to Claim 22 further comprising a band pass filter connected between said random noise source and said amplifier, said band pass filter controlling a frequency spectrum of the random noise from said random noise source.